update
UNITED NATIONS CENTRE FOR SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

No. 46/Summer 1991

Renewable Energy — Issues for the 1990s

Demand for fossil fuels in the long term, especially for oil and gas, will deplete global reserves to the point where prices will rise dramatically. However, on the basis of current estimates, global resources are probably sufficient for 50 to 100 years at present and projected consumption levels, and within a tolerable price range of less than $40 a barrel for oil. That said, renewable energy sources are of interest in the short term for four main reasons:

• Many oil-importing developing countries have heavy burdens of international debt which are aggravated by the cost of imported oil, and these countries are looking for ways to reduce this burden.

• Unlike the industrialized countries which have extensive electricity supply grids, networks of oil and gas pipelines, and other means of distribution, most developing countries have large rural populations with little hope of energy connections through conventional means in the near future. In many cases, renewables such as photovoltaics, offer a possible way ahead.

• Populations in developing countries which rely on fuelwood for up to 70 per cent of their domestic energy are facing acute shortages of biomass to

Brian Lies

burn. They are destroying their soil and agricultural base by cutting and burning woodlands and exposing precious land resources to erosion and desertification.

• The burning of fossil fuels creates environmental problems at several levels including: global warming from the release of "greenhouse" gases, especially carbon dioxide; acid rain, especially from sulfur and nitrogen oxides; photochemical smog in urban areas, mostly from motor vehicle exhausts; soot, dust and particulate matter; oil spills and environmental damage related to the transportation of fossil fuels; the threat to the ozone layer, which is partly related to the burning of fossil fuels.

It is the environmental threat which has sparked fresh interest in renewable sources of energy, particularly in the developed countries.

Against this background the outlook for renewable energies would appear to be bright, although quantifying their prospects for the 1990s is not an easy thing to do. With the exception of large-scale hydropower, the existing market

(Cont. Pg. 2)

Inside

Environmental Auditing Pg. 3
Renewables and Global Energy Pg. 4
Less Talk of Peace Dividends Pg. 7
Technology and the Sahel Pg. 8
ATAS News Supplement

IGC Sets Course For 1990s

The Intergovernmental Committee on Science and Technology for Development met for two weeks in New York (22 April—3 May) to discuss means of securing a productive role for developing countries in a world economy driven by rapid scientific and technological change.

The Committee gave particular attention to the need to facilitate the access of developing countries to environmentally sound technologies; to accelerate the transfer of these technologies to developing countries under favourable terms; and to strengthen their capacity to develop environmentally sound technologies of their own through research partnerships and international co-operation.

The Committee decided to make its reports and deliberations on this subject available to the Preparatory Committee for the 1992 United Nations Conference on Environment and Development.

Special presentations

Highlights of this year's 11th session of the IGC included special presentations by three prominent speakers on matters related to the application of sci-

(Cont. Pg. 2)

Renewable Energy

(Cont. from Pg.1)

is small and fragmented, projections from past trends have proved unreliable, and only a few technologies are mature in the sense that reliable equipment is commercially available. Even where technologies are mature, the markets are usually too small to allow economies of scale in production. Photovoltaics are an example.

Another major brake on the development of renewables has been the generally low level of public and political awareness and acceptance of energy options. Recognition of the issues has also not yet matured to the point where renewables can compete on a level playing field. Many of the environmental and other disadvantages of fossil fuels are "externalities" which should be factored into their prices, together with the various public subsidies which support the continued use of fossil fuels at the expense of the treasury and the environment. ■

IGC Sets Course

(Cont. from Pg.1)

ence and technology. Professor Essam El Din Galal (Egypt), former chairman of the Advisory Committee for Science and Technology for Development, and one of the promoters of the Vienna Programme of Action, spoke on the role of the United Nations in Science and Technology for Development; United States Congressman, Bill Alexander (Democrat, Arkansas) spoke on 'Global efforts needed to bring about a new day in energy' (See story Pg. 3); and Dr. Manuel Elkin Patarroyo, Director of the Institute of Immunology of the National University of Colombia, spoke on biotechnological research in Latin American countries based on his experience in discovering the first successful synthetic vaccine against malaria. These presentations were a first for the IGC and they raised the prospect of an expanded forum to hear the views of technical and other experts when the 12th session convenes again in 1993.

Report of S-G

A report of the Secretary-General to the Committee, stressed the importance of a true global partnership for sustainable development. The report called for concerted action which would enable the developing world to shoulder its share of responsibility towards international conventions for the protection of the environment. It cautioned: "The world may be moving towards an environmental crisis that will seriously affect the development prospects of all countries."

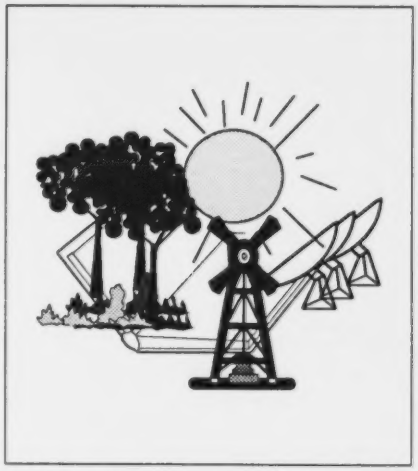
Interdependent

The report noted the interdependence of rich and poor nations when faced with the global consequences of climate change and global warming, depletion of the ozone layer and the loss of biodiversity. These global problems demand remedies on a global scale, and the transfer of resources, financial and otherwise, to developing countries is essential if meaningful solutions are to be found: "The industrialized countries possess the technologies as well as the financial and institutional means to monitor and mitigate environmental damage. They virtually dominate research and development of environmentally sound technologies; they also, in principle, control the transfer of such technologies to developing countries. Furthermore, the industrialized countries have the capacity to make best use of those technologies according to their different needs. In contrast, developing countries are disadvantaged in most of the above-mentioned respects. Targets for developing countries must be formulated on realistic terms of responsibility, affordability and capacity, thereby enabling developing countries to react to global environmental challenges without sacrificing their legitimate rights to economic growth."

Substantive theme

The Committee also decided that the substantive theme for discussion at the 12th session should be:"The contribution of new and emerging technologies for the industrialization of developing countries and for the strengthening of regional and global integration processes, including proposals on ways and means of transferring such technologies, and of their incorporation in the productive sector of those countries."

The Chairman, Ladislav Kovac of Czechoslovakia, said the world was in "serious disequilibrium" but he believed that science in the 1990s would provide

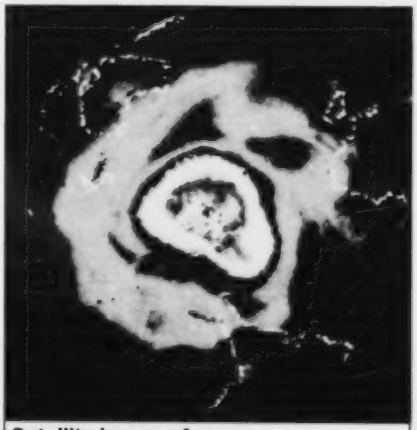


the knowledge and opportunities to narrow the gap between developed and developing countries.

The Director-General for Development and International Economic Cooperation, Antoine Blanca, said science and technology alone could not close the gap between countries of the North and South, but could serve as catalysts for solutions to the disparities between rich and poor.

Appeal for support

The Director and Officer-in-Charge of CSTD, Lutz Baehr, stressed the importance of involving legislative as well as scientific bodies in future sessions of the Committee. He also appealed for support for scientists in Least Developed Countries (LDCs) who were often isolated from the mainstream of scientific discussion for reasons related to geography, poor communications and inadequate financial resources to participate in international scientific and technological forums. ■



Satellite image of ozone hole over Antarctica

Optimistic About US Fuel

Efforts by major oil companies to head off changes in America's fuel consumption patterns are becoming politically less sustainable by the day, according to US Congressman, Bill Alexander.

Congressman Alexander (Democrat, Arkansas), a member of the US Alternative Fuels Council, and a strong supporter of ethanol as a fuel option, told the 11th session of the Intergovernmental Committee on Science and Technology for Development (April-May) that policymakers in Washington were now focusing on two aspects of the hydrocarbon fuels issue:

- the impact of a continued dependence on oil on national security and the economy; and
- potential damage to the environment and public health caused by burning hydrocarbon fuels.

"Those concerns are merging, permitting the formation of a newer, stronger coalition aimed at reducing dependence, and at increasing the use of natural resources in our country for fuel production", he said. "In the case of ethanol, the premise we are following in this country is simple. We are seeking ways to become more dependent on grain fields and less on oil fields for the fuel to power our economy. Such a shift in energy use patterns will give America not only a cleaner fuel, but one which is renewable and less fraught with military and foreign policy implications."

Congressman Bill Alexander

Congressman Alexander noted that the Congress had passed a Clean Air Act in 1990 for more oxygen to be included in the nation's fuel supply, and that the Alternative Fuels Council this year had passed a resolution calling for the displacement of 25 per cent of gasoline and other traditional fuels with alternatives by the year 2005. In addition to ethanol, those alternative transportation fuels include methanol, electricty for vehicles, and compressed natural gas. ■

Meeting Will Present Two Main Themes

The joint annual meeting of the Society for Social Studies in Science, and the European Association for the Study of Science and Technology, will be held at Gothenburg, Sweden, (12-15 August 1992).

The conference has two preliminary themes. The first will address the relationship between science, imperialism and development — '500 years after Columbus'. The second —'Europe after 1992'— will look at the implications of European integration for science and technology.

The deadline for paper proposals and abstracts is 31 October and the organizing committee notes that it is willing to consider "new and revolutionary topics".

For further information please write to: John Hultberg, Centre for Science Studies, S-41298 Gothenburg, Sweden.
Fax: 46 31 63 47 23.

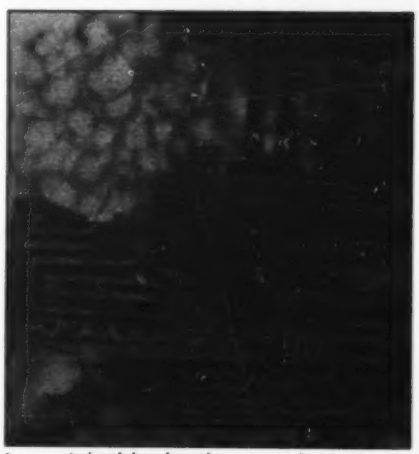
Environmental Auditing

More than 700 business leaders who attended the Second World Industry Conference on Environmental Management (WICEM II, Rotterdam, April) agreed to provide more comprehensive information about their companies' environmental performance to employees, shareholders, government authorities and the general public.

The three-day conference organized by the International Chamber of Commerce (ICC) agreed to include environmental statements in their annual reports and actively to support the concept of sustainable development. They proposed that major corporations and industry associations examine the possibilities for setting up regional groupings on environmental wastes, and for providing small and medium-sized industrial firms with technical advice and information on the treatment and disposal of wastes.

Companies represented by top executives at the conference included: Alcoa, Akzo, British Petroleum, Du Pont, General Motors, Henkel, IBM, Lyonnaise des Eaux-Dumez, Mannesmann, Norsk Hydro, Phillips Petroleum, Rhone Poulenc, Shell, and Union Carbide.

The executives pledged their support for educational programmes to promote sustainable development in and outside industry, and they asked the ICC to launch an industry initiative in environmental education. ■



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Renewables Provide 25 p. c. of Global Energy

By Bent Sørenson

After a period of neglected renewable energy research and development, the 1973-1974 oil crisis spurred a number of efforts aimed at the rapid development of renewable energy options.

Several of these technologies have become economically viable, while the marketability of others remains uncertain.

The current renewable energy situation can be briefly summarized as follows:

Solar

Flat-plate solar collector systems for space heating and hot water have reached technical viability in several parts of the world. Hot water systems are in widespread use in areas with low space heating requirements, but are only economic where they can be integrated into the roof structure of new buildings.

Photovoltaic collectors have gone through a continuous development process and have found an increasing number of niches in the marketplace. However, with oil fuel costs at their present level, they are still too expensive for consideration as a replacement for bulk power generation. Solar concentrating devices are still basically in the experimental stages, with indicated costs above those of current alternatives.

Wind

Horizontal axis wind turbines have been perfected and have gained a fair market position in Denmark and California, and their use has recently spread to other areas as well. In regions with good wind conditions, they are cost competitive or almost competitive with fuel-based alternatives for bulk electricity production up to 25 per cent of demand (i.e. as long as dedicated energy storage is not required). A factor in their competitiveness is that service and maintenance be available locally.

Wave, tide, geothermal

The use of wave and tidal energy is still in the early developmental stage and prototype installations have had their problems.

The use of geothermal energy is widespread, but few installations operate in a renewable mode.

Hydro, biomass

Hydro and biomass technologies have the largest share of renewable energy use.

The expansion of large scale hydropower is approaching saturation because of cost and environmental reasons, but continued development is making small-scale hydro plants cost-effective in many places.

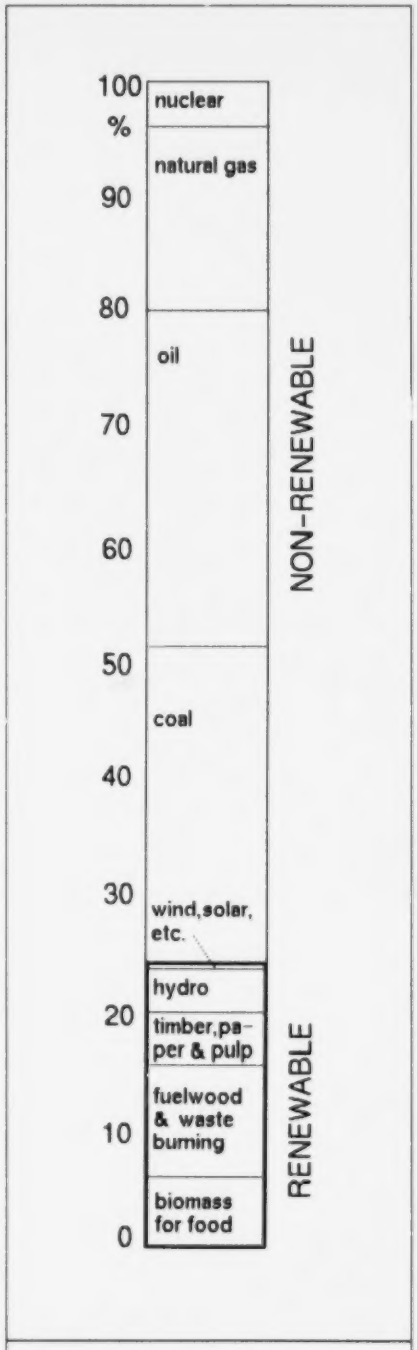
The burning of biomass remains widespread in developing countries and in forest-rich industrialized countries, despite adverse environmental effects. Biomass use includes food production (which is basically an energy use).

Biogas

Biogas production operates at two levels. The first is in relatively primitive, labour intensive domestic and other facilities, in Asia in particular. The second is in fully automated plants in industrialized countries such as Denmark. The experiences are mixed, but a number of technically and economically viable installations have emerged in both areas.

The production of liquid biofuels continues in a number of countries including Brazil and South Africa, but on a direct economic basis this cannot currently compete with fossil fuels. If indirect economies, including the effect on import/export ratios, are considered, the picture might be different.

At the present time, renewable energies command 25 per cent of the total energy picture, including non-energy uses such as those in the timber, paper and pulp industries. Over the next few decades it should be possible to double this global contribution to 50 per cent.



Current global energy use

This is a very ambitious goal, but one which is technically feasible. ■

Dr. Bent Sørenson is Professor at Roskilde University Centre, Denmark, and President of NOVATOR Advanced Technology Consulting. He is the author of many articles and books.

ATAS News

No. 13/Summer 1991

Counting the True Cost of Development

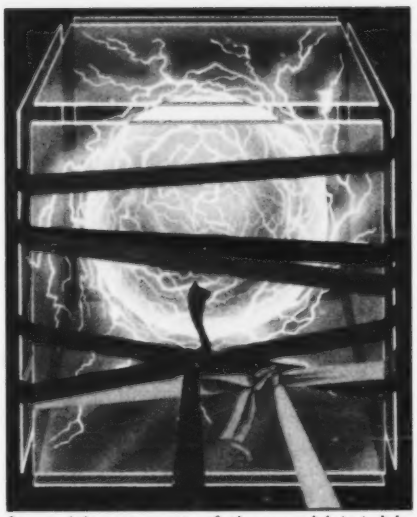
Economic growth, social mobility and cultural expression are unthinkable without energy. It fires our industries, fuels our agriculture, and keeps our houses warm or cool. It enables us to cook our food, pump our water, communicate and travel from place to place.

The energy for these everyday activities is so abundant and accessible in the industrialized world that consumers have tended to take it for granted, pausing only in recent years to consider their overdependence on fossil fuels and the implications this has for the global environment.

Media attention to the phenomenon of global warming related to the buildup of 'greenhouse' gases such as CO_2, NOx and SO_2 in the earth's atmosphere, has spurred a drive for cleaner fuels and energy-efficient technologies. It has also helped to promote public awareness of the fact that pollution, wherever it occurs, can have consequences reaching far beyond the borders of those directly responsible for it.

The scientific, public, and political forces now at work in the industrialized world to change consumption patterns and address the need for new and renewable sources of energy will however take much longer to influence neighbours in the developing world who have limited financial and technological options for change at their disposal. It is obvious that they will need help to develop sustainable patterns of development and that the cost of ignoring their needs could be astronomical for the world at large.

Driven by population growth and rising standards of living, energy consumption in developing countries grew



from 14 per cent of the world total in 1973 to 22 per cent in 1987, and it could exceed 32 per cent in the year 2020. Over the next four decades, the population of these nations is likely to treble, and their energy demand could quadruple. The mix and match of energies which they consume will have a profound effect on climate and development at home and abroad.

If one takes the principal greenhouse gas CO_2, just three countries — the United States, the Soviet Union, and China — currently account for half of the world's total emissions. Population growth in the United States however, is near zero and energy consumption patterns have entered a post industrial conservationist mode. China's population continues to grow and the country moved from the 10th largest CO_2 producer in 1950 to third largest in 1987. India, the world's second most populous nation, moved from 13th place to seventh. The United States' output of CO_2 meanwhile, slipped from 42 per cent of the world total to 26 per cent. Other industrialized countries have also found ways to lower their CO_2 ranking — the United Kingdom from third to sixth place, and France, from fifth to 11th.

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New Climate For Development

Unlike the 1970s and early 1980s when international dialogue often foundered on confrontation, the 1990s have brought a new pragmatism reflected in a willingness to explore new avenues for development.

Developing countries, more than ever, are recognizing the value of measures to re-orient their internal development strategies to gain the maximum benefit from external assistance. And industrialized nations are seeking new ways to involve developing countries in open policy discussions on issues of common concern.

How best to capitalize on this new openness, was the subject of a conference on 'International Co-operation in Science and Technology for Development', held at Dalecarlia, Sweden, (10-12 June). The conference was hosted jointly by CSTD and the Swedish Agen-

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Counting the Cost of Development

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It is daunting to note that 36 per cent of the developing world's commercial energy consumption is from coal, with the two most populous nations — China and India — burning most of it.

Although the energy field is rich in alternatives, clean and renewable sources such as solar, wind, tidal, and geothermal, are not available universally and the technologies to exploit them most efficiently reside mostly in the private sector of the industrialized world. The harsh reality is that many, if not most, developing countries cannot easily change their domestic fuel consumption habits, or afford to import solutions embodied in advanced technologies from abroad. There is no easy answer to the question of who will foot their bills, but the international community can be sure of one thing: The environmental consequences of inaction will be global, and the costs, one way or the other, will be borne by rich and poor. There is an urgent and inescapable need for international negotiations not only on standards for reducing future emissions, but also for a fair global apportioning of the costs.■

New Climate for Development

(Cont. from Pg.1)

cy for Research Co-operation with Developing Countries (SAREC), and was attended by some 40 scientists and policymakers from developing countries. Representatives from United Nations and donor agencies, and NGOs also participated.

One main topic for discussion was the value of national dialogues between leading stakeholders in the economies of individual developing countries, which CSTD has promoted in Nepal and Tanzania and plans to support in seven other nations. Such dialogues are considered to be a practical approach to the identification of national development priorities which are shared by scientists, the private sector and government policy makers. They are also considered to be helpful to the formulation of concrete policy recommendations, programmes and projects.■

Generating More Power for Less

Developing countries should think seriously about conservation before pushing ahead with plans to build costly new electrical power plants.

According to Howard Geller, associate director and principal researcher at the American Council for an Energy Efficient Economy (USA), energy-wise nations can save millions, if not billions of dollars by using what they already have more efficiently. It costs in the range of $2,000 to $7,000 per KW to build a power facility, but anywhere from a few hundred dollars to $1,000 per kW, to install energy saving technologies.

In a paper for CSTD's forthcoming ATAS Bulletin on "Energy Technologies and Development", Geller notes that developing countries currently generate 20 per cent of the world's electrical power, with production growth averaging almost 7 per cent a year between 1980-1986.

"Rapid expansion of electricity supply is costly and difficult", he said. "With moderate economic growth, developing countries might need to invest around $125 billion per year in electricity supply over the next 20 years. This is an enormous and overwhelming investment requirement considering current debt burdens and financial difficulties in many developing nations. Many countries already experience power shortages and others will begin to as demand growth surges ahead of generating capability."

Geller, who is currently helping Brazil to develop conservation programmes for its power utilities, says that electricity conservation can be achieved without reducing economic growth or lowering living standards.

"Cutting back on the construction of costly new power plants reduces public debt and the need to increase tariffs", he said. "Also, more customers can be added to the power grid if there is a transition to more efficient equipment among all customers." He notes that electricity conservation can also reduce the dislocation caused by the construction of new hydropower dams, as well as the environmental impact of pollution and waste disposal problems associated with coal-fired and nuclear power plants.

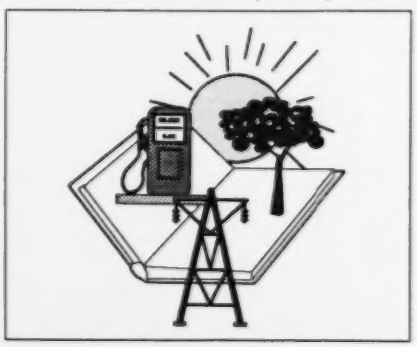
In Brazil, the PROCEL conservation programme funds dozens of projects for the development and demonstration of more efficient technologies, market research, product testing, efficiency labelling, auditing, public education and hardware installation. As of 1988, PROCEL had directly or indirectly generated electricity savings of about 1,000 gWh/yr, the equivalent of output from a 200 MW power plant over the same period. PROCEL's target is to save 41,000 gWh/yr within the current decade.

"In practical terms, utilities and energy agencies must establish and adequately fund conservation departments," said Geller. "Specialists are needed in a variety of disciplines, including engineering, consumer behaviour, and programme development, implementation, and evaluation...Utilities conceiveably could sponsor incentive and financing programmes as well."

Geller said that in market economies, greater end-use efficiency will come largely through efforts within the private sector. Governments can spur this process by:

- assisting entrepreneurs who are attempting to manufacture and/or market energy-efficient products, by offering financing and government procurements;
- encouraging joint ventures and licensing arrangements between local and foreign companies involved in the production of more efficient equipment.

Geller said nations could save billions of dollars if they would only take end-use efficiency as seriously as they do the construction of new power plants.■



Renewables Gain Despite Obstacles

By Thomas B. Johansson

During the 1980s, remarkable progress was made in the development of renewable energy technologies in the face of formidable odds. Progress was achieved despite new discoveries of fossil fuel resources, falling oil prices, a 50 per cent reduction in government expenditures on renewable energy research and development, and subsidies for conventional energy sources.

Wind power generation costs have been reduced by a factor of 10, due largely to standardization and organizational learning, and wind power is now competitive with conventional power generation in many applications. Approximately 2000 megawatts (million watts, MW) of wind power have been installed.

The costs of electricity produced with photovoltaic cells has been reduced by a factor of four and, although still too high for base-load power production, it has become competitive in many market niches.

Biomass

Biomass-based power generation has increased from almost nothing to 9000 MW in the United States alone, due largely to utility regulatory reforms.

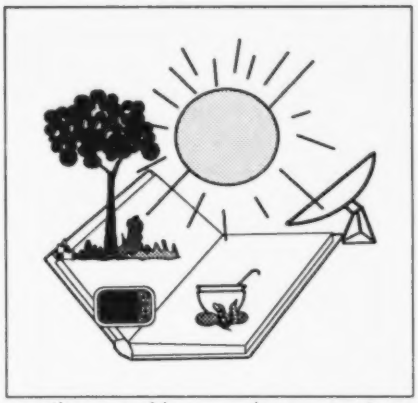
Solar thermal electric generating capacity has expanded to several hundred MW in the United States, although costs remain relatively high.

Renewable sources of energy now provide approximately 14 per cent of humankind's energy needs. Almost half of this is supplied by large scale hydropower facilities, while the other half comes from traditional biomass resources. Renewable-energy technologies that are currently available and cost effective from a societal perspective can contribute a significantly larger amount of energy globally. If the use of biomass is modernized and much higher conversion efficiencies are achieved, it can provide an abundant source of renewable energy. In the long term, all of humankind's energy needs can be met in environmentally benign ways, using a minute fraction of the global physical renewable resource.

Biomass and photovoltaics are the most promising future renewable energy sources. Their potential contribution to world energy supply is substantial, as is their potential to stimulate sustainable development and to displace current energy systems which are causing serious environmental degradation. They are unlikely to be used at scales large enough to realize those potentials however without government action on both national and international levels. Co-ordination is needed to ensure congruous planning and policy-making which promotes renewables and discourages unsustainable energy practices. Education, training and information programmes are needed to support rapid, widespread and effective application of efficiency-improvement measures and renewable energy technologies. Research and development are needed to improve emerging technologies, drive down their costs, and adapt them to developing country settings. Adequate financing and institutional infrastructure are needed to bring these changes about. Achieving this will require commitment, leadership, and co-operative efforts from the world's governments.

Interest Grows

Awareness of these issues has led to increased interest within the United Nations to promote the use of new and renewable sources of energy (NRSE). In April 1990, the United Nations Committee on the Development and Utilization of New and Renewable Sources of Energy asked that the Secretary-General prepare a "significant contribution to the United Nations Conference on Environment and Development" which is to be held in Brazil in June, 1992. In response, the United Nations Director General for International Economic Co-operation, convened a group of experts known as the United Nations Solar Energy Group for Environment and Development. This group has held several meetings, and is preparing a report examining the potential contribution of NRSE to sustainable environment and development, for the sixth meeting of the NRSE committee in January 1992.



Professor Thomas B. Johansson of Lund University, Sweden, is Chairman of the United Nations Solar Energy Group on Environment and Development.

Mini-Micro Hydro

Some technically-minded Nepalese villagers are harvesting water power from a nearby creek to run 12 volt radios, TVs and tape-recorders.

More than a dozen households in the Ilam villages of Shantinagar, Kerabari and Ahali, have fashioned water drive paddles to bicycle wheels connected to standard bicycle dynamos.

These ingenious devices generate sufficient power to operate small appliances and recharge household zinc batteries, but there is an enduring problem with burnout of the dynamos,

(Cont. Pg. 4)

Japanese Guide to Good Corporate Housekeeping

The Federation of Economic Organizations in Japan (Keidanren) has announced a set of guidelines which it hopes will shape future corporate behaviour towards the environment, employees and consumers, at home and abroad.

The 'Keidanren Global Environment Charter', unveiled at the 11th session of the Intergovernmental Committee on Science and Technology for Development, held in New York (April-May) is a thoughtful yardstick for corporate citizenship which Keidanren believes is essential to the healthy development of Japan's economy.

"A company's existence is closely bound up with the global environment as well as the community it is based in", says Keidanren. "It must carry out its activities while maintaining respect for human dignity, in harmony with the goal of achieving a future in which the global environment is protected."

The Charter urges Japanese corporations to:

- develop management policies for the protection of the environment in which they operate, the conservation of resources, the environmental soundness of their products and the protection of the health and safety of employees and local citizens.
- establish internal systems for environmental matters under a director responsible for environmental regulations and regular inspections.
- ensure that the research and design of products consider their possible burden on the environment, and draw on technologies which are energy efficient and produce few pollutants and unusable by-products.
- help develop and supply innovative energy – and resource-efficient technologies and products.
- transfer technologies, know-how and expertise to deal with environmental problems.
- provide technological and other appropriate assistance in the event of environmental or safety emergencies at company sites, whether or not the corporation is directly responsible.
- promote environmental awareness through information and education activities directed to employees and users of company products.
- promote an environmental dialogue in communities where plants operate.
- observe all local environmental health and safety laws as a minimum standard. Japanese domestic standards should apply overseas if they are higher.
- co-operate in scientific research into the cause and effect of such problems as global warming. ■

Mini-Micro Hydro

(Cont. from Pg.2)

which were not built for continuous operation. The Nepalese point out that their innovation would be much more useful if someone could supply them with durable mini-micro-hydro dynamos at a reasonable price.

If anyone has a solution, please write to Kanak Mani Dixit, Editor of the Nepalese bi-monthly magazine 'Himal' PO Box 42, Lalitpur, Nepal. Fax: 977 1 521013. ■

Wind Energy

The cost of wind-generated energy has fallen dramatically over the past decade to become one of the least costly sources of renewable energy.

The California Energy Commission (CEC) estimates that wind power plants operated by an investor-owned utility can generate electricity for 4.7–7.2 cents/kilowatt hour, making it competitive with coal and nuclear power. Wind plants are capital intensive, but the fuel is free and clean, and field tests suggest that the operation and maintenance of wind plants costs one third less than for nuclear power plants.

The CEC notes that wind turbines installed since 1985 are also 46 per cent more efficient and less inclined to break down. They provide commercial bulk power on electricity grids in California, Hawaii, Denmark, Germany, Spain, the Netherlands and India.

About 80 per cent of the world's wind generation is in California where more than 15,000 wind turbines are privately owned and operated, and they save the energy equivalent of 4.4 million barrels of oil per year.

It is estimated that in 1990, California's wind power plants offset the emission of more than 2.5 billion pounds of carbon dioxide and 15 million pounds of other pollutants that would otherwise have been produced. It would take a forest of 90 million to 175 million trees to provide the same air quality benefit.

For further information, please write to: Randall Swisher, Executive Director, American Wind Energy Association, 777 N. Capitol Street N.E., Suite 805, Washington D.C. 20002 USA. Fax: 202 408 8536. ■

ATAS News **is a regular supplement to the *Update* newsletter of the UN Centre for Science and Technology for Development (UNCSTD). Its objectives are to inform scientists and planners of CSTD's activities in technology assessment (TA), to serve as an information medium for the ATAS Technology Assessment Network (TAN) and to highlight the implications of new technologies for developing countries. *ATAS News* offers readers an open forum to address these and related issues at the national, regional and international levels. Submissions for publication are welcome.**

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ATAS News **is edited by Ian Steele.** ■

Market Remains Small for Small Energy Resources

By Antonio Naviglio

Technologies to utilize small energy resources (SER) have developed considerably in recent decades. However, their various applications have not increased very much on a global scale and the great success of some has generally been attributable to site-specific factors.

The main impediment to a wider use of SER technologies has been the low cost of oil. The advantages of oil-derived fuels are so substantial that in a period of low oil prices, technologies requiring a generally high investment have been disregarded. The recent steep increase in oil prices could, however, be a major stimulus to the use of SER technologies.

Photovoltaics

Photovoltaic technologies provide a reliable source of energy in remote areas of the developing world where power requirements are small but important, as in the cases of communications and refrigeration, or power sources for health facilities. In areas where supply needs are small, sunlight is abundant and the water table is high, photovoltaics are competitive with diesel power for pumping. Technological improvements, mainly in the quality of overall systems design, including the end-user components, are, however, necessary to enhance the attractiveness of PV technologies.

Hydropower

In the field of small scale hydropower, PV is a proven and common technology for the production of off-grid electricity and the generation of shaft power, although low capital costs, good water conditions, and high load factors are necessary if small hydropower is to compete with other resources.

Wind energy

Wind energy is used mainly in developing countries for mechanical pumping, and when wind regimes are good and the volume of water needed is low, it compares favourably with diesel power. It is only viable, however, if the design and maintenance of the system are relatively simple.

Biomass

Commercial-scale biomass systems have been successful when biomass feedstock is readily available on site, but household systems have often been found not to be competitive with other fuels, in addition to being difficult to manage and maintain. The direct combustion of wood or other biomass for steam can be cost-effective, although a further scaling down of the currently available systems is necessary for many small scale applications.

Wastes from sugar mills, wood product industries and rice mills can be attractive sources of biomass for electrical generation but the location of the plant in relation to the source is critical to cost-effectiveness.

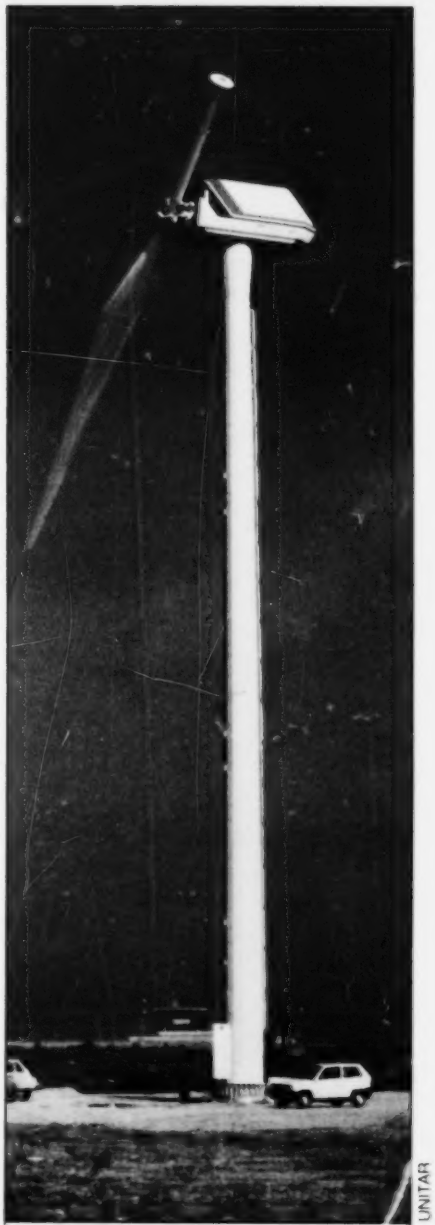
Although ethanol production is not usually competitive at current oil prices, other factors play a large role in its viability. These include the availability of biomass sources such as sugar cane, the cost of domestic oil, the relative importance of foreign exchange and possibilities for generating employment.

Geothermal

Geothermal reservoirs have been successfully tapped for electrical power generation in many developing countries although there are several constraining factors including: resource location versus electrical loads, the ability to assess accurately the capacity of the reservoirs to be tapped, and the quality of local maintenance and management personnel.

Solar

Site-specific factors related to climate and market have a major bearing on the viability of solar power. Solar systems are often competitive with other options for water heating and drying but much depends on the local availability of low cost materials and equipment. ■



UNITAR

Wind turbine — Italy

Antonio Naviglio is Director of the UNITAR/UNDP Centre on Small Energy Resources.

Military Conversion — Possibilities and Myths

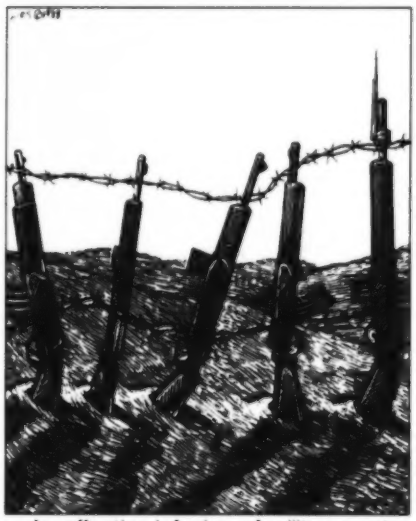
By Lloyd J. Dumas

There is so much mystification and misunderstanding surrounding technology that it is difficult for most people to understand the challenges and opportunities represented by the release of large numbers of engineers and scientists from military-related activity.

On the one hand, the tendency to over-estimate the malleability of both technology and technologists leads to a lack of appreciation of the difficulties involved in transfering them to new applications in the very different world of civilian-oriented research and development. On the other, the tendency to view technology as magic leads to over-estimation of the extent to which technology is capable of solving pressing human problems, and so to over-optimism as to the kind of progress likely to be ushered in by the shift in technological focus triggered by the end of the Cold War. How successfully, and in which direction nations redeploy their technological resources depends upon the degree to which government decision-makers and the lay public can be brought to a more realistic understanding of the problems of technological conversion and the goals it can reasonably achieve.

Reshaping human resources

A great deal of properly designed retraining and reorientation of military sector engineers and scientists will be needed to reshape their skills and to attune their perspectives with the requirements and goals of civilian R&D. Programmes to accomplish this will be both time consuming and costly enough to require appreciation of their importance in order to assure sufficient public support. Unless attention is given to this aspect of conversion, it will not be possible to re-employ efficiently the vast majority of engineers and scientists released from military activities in civilian R&D. The loss of the enormous social investment in their skills and capabilities that this implies would be a great tragedy.



Brian Lies

An effective infusion of military sector technological resources into civilian activity offers the promise of great progress in a number of areas of vital concern. Global warming, acid rain and a variety of other ecological problems cry out for the development of alternative, ecologically benign energy sources, improved technologies for energy use and storage, and better techniques for waste treatment and disposal. Rising international concern with global environmental issues makes it increasingly likely that some released military sector R&D resources will be used for such purposes. That would certainly be wise.

As the world moves towards less militarized views of security, reduced pressures for secrecy will enhance the possibilities for joint exploration of space-based technologies for a variety of peaceful purposes. This expensive and risky enterprise would clearly benefit from greater international co-operation and scientific exchange. Increased civilian R&D along these lines is highly likely. Medical technologies also constitute an area in which converted military technologists could be usefully employed, particularly in areas where the skills of physical scientists and engineers intersect medical needs. Obvious opportunities exist for the development of advanced prosthetic devices, diagnostic equipment and instrumentation for medical research and practice.

The fact that the great majority of global engineering and scientific activity takes place in the more developed countries makes it less likely that the skills of converting technologists would be applied to the kinds of R&D needed for effective development in the LDCs. To ignore this kind of R&D would be a great mistake, but it is a mistake which is very likely to be made in the absence of concerted pressure by the LDCs for a share of the technological peace dividend.

Most probably, the majority of converting military sector technologists will be redeployed in industrial R&D which is not radically different from that currently under way. This will enable producers in those industrialized countries which have been heavily engaged in military R&D to compete much more effectively with producers in those industrialized economies which have been only lightly burdened by military activity. This might appear threatening to some, but it portends a substantial long term improvement in global standards of living.

The opportunities implicit in military conversion are great, but it is important not to over-sell them. It has always been true, and it remains so, that the most pressing human problems, from the arms race to world hunger, cannot be solved in the technological arena. No amount of improvement in agricultural technology for example, will solve the problem of world hunger. The world already produces more than enough to feed its entire population. Hunger persists because of socio-economic and political arrangements, not because of technological backwardness. At base, these problems are economic, social and political. They are not subject to technological fixes. They must be solved in the economic, social and political arena or they will not be solved at all. ■

Lloyd J. Dumas is Professor of Political Economy at the University of Texas (Dallas).

Less Talk of Peace Dividends

By Nancy Gordon

Events in early 1991—the war in the Gulf and the chill in the Cold War thaw—have lessened talk of peace dividends and the conversion of military expenditures to civilian uses. Nevertheless, it is still reasonable to hope and plan that military budgets will not regain their 1980 levels—at least as a percentage of national budgets—as the 1990s progress.

What will be the effects of these reallocations? And what are the problems associated with getting from here to there?

It is sad but true that in many of the countries of the North, monies diverted from the military will be used to make a dent in growing deficits. In the Spring of 1989, Canada's Finance Minister reduced the defence budget by closing a number of military bases and by postponing major acquisitions. The monies saved were not directed to research and development in the civilian sector. Nor were they allocated to the foreign aid budget (which was reduced at the same time). The exercise was solely a deficit-cutting one.

Canada ranks among the more fortunate of the world's economies and has a reputation as a generous aid giver. But any cuts from the defence budget are, in the foreseeable future, unlikely to be earmarked for R&D in the civilian sector, either in Canada or abroad. While Canadian deficit problems may not be as acute as in other developed states, there are certainly similar pressures amongst Northern countries.

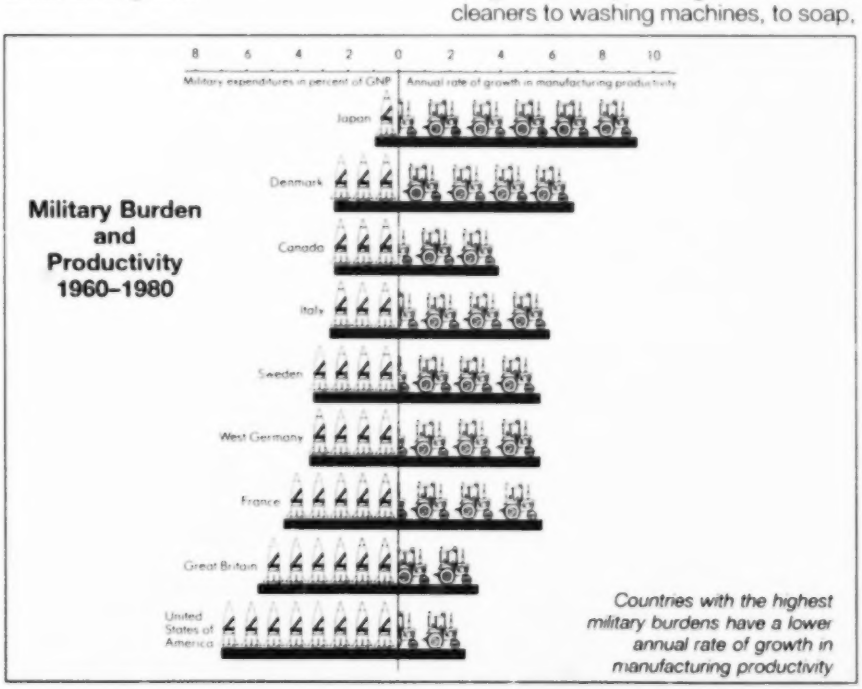
Visionary expenditures are an attractive means of helping governments cut defence budgets and channel the savings into more productive expenditures. Spending on the environment for instance, is likely to be more politically attractive in many states. Spending on decaying infrastructures, especially in urban settings, is another.

In developed market economies, questions of demand inevitably arise. If we research, develop and produce a new 'widget' will there be a demand for it? Such is not the case in the centrally planned economy of the Soviet Union where, with major shortages of everything from baby carriages to vacuum cleaners to washing machines, to soap, to trousers, demand is high for almost anything which can be produced. But factories which produce tanks and guns and artillery pieces do not easily produce strollers for babies, clothes dryers or boots, warming as that symbolism may be.

For the past five years in the Soviet Union the political will has been strong to spend less money on the military and more on the civilian economy in order to restructure the economy and improve the standard of living of Soviet citizens. The political leadership in the Kremlin, along with a plethora of Soviet economists, recognized that the best brains and the most money had been going to the military. The military was efficient, and the civilian-based economy was not. And yet, even with these incentives, there has been little positive change.

It is true that there were a variety of views about how to go about the diversion of funds from the military and the conversion of those funds to civilian production. And the military undoubtedly resisted the pressure with stalling tactics. The major problem however, has not been one of military resistance, but of figuring out how to do it. Sophisticated military expenditures require skills, training and experience which is not easily adaptable. Design engineers for nuclear-powered submarines for instance, are not able automatically to draw the specifications for the production of vacuum cleaners. The production of quality civilian manufactures suitable for export, requires different, but equally demanding techniques, expertise and know-how.

While these are not easy problems to solve, their solution is essential to the development of more humane societies in all parts of the world. Slogans such as 'peace dividend', 'conversion', 'disarmament and development' belie the complexity of the tasks. ■



Countries with the highest military burdens have a lower annual rate of growth in manufacturing productivity

Nancy Gordon is Director, Public Programmes, Canadian Institute for International Peace and Security.

Technological Salvation Proposed for Sahel

The Regional African Centre for Technology has proposed a package of available technologies and alternative energies to reforest and resettle a 30 kilometre belt across the African Sahel.

The proposed package would tackle the region's dependency on fuelwood for 70 per cent of its domestic energy through the introduction of smokeless coal briquettes and natural gas. And it would introduce solar water pumping and solar water desalination plants to irrigate and resettle denuded lands stretching from Mauritania to Ethiopia.

Dr. E. N. C. Osakwe, a renewable energy technologist based in Dakar, Senegal, has proposed that UNCSTD establish a technical coordination committee with other relevant United Nations agencies and regional groups to oversee a plan which would, among other things:

- introduce modern agricultural techniques to combat the shifting cultivation which is causing severe erosion in fragile desert soils;
- establish a man-made vegetation belt of 25 to 30 kilometres along the southern frontiers of the Sahara from the Atlantic coast to the Red Sea;
- support a transition from ecologically destructive fuelwood dependency through the introduction of coal-burning stoves and simple natural gas cookers. It is proposed that a natural gas distribution network be established to utilize an estimated 350,000 barrels (oil equivalent) of gas which is flared from Nigerian oil fields daily. Dr. Osakwe notes that commercial technologies have been available for several decades to transport safely natural gas or derivatives such as methanol, as fuel or as fertilizer stock. ■

Expanded Role for ACSTD ?

The Chairman of the Advisory Committee on Science and Technology for Development (Prof. C. H. Geoffrey Oldham) proposed to the IGC in April that ACSTD build working links with other parts of the United Nations system, including its sister Advisory Committees.

Professor Oldham said that the Advisory Committee could make its greatest contribution to the United Nations by: clarifying concepts; determining priorities; and by proposing solutions to problems.

He said that in addition to its report to the IGC's 11th session, the Advisory Committee had made a substantive input to preparatory discussions for the Fourth Development Decade, and had held discussions with representatives from a number of United Nations Specialized Agencies and Regional Commissions. ■

SOLAREX

Solar-powered Relay Station — Thailand

Analysing Problems

The Stockholm Environment Institute is inviting enquiries about its research programme on energy, environment and development.

The programme is in six parts and focuses on Urban Energy, Rural Power, Household Energy, Energy Planning, Technical Information and Scoping Studies. Its aim is to identify and analyse urgent and neglected energy problems in developing countries.

The programme's information arm has a library focused on environmentally sound and appropriate technologies including renewables with rural applications. The Institute produces 'Users Guides' on specific energy technologies, and supports a newsletter.

Enquiries should be directed to: Arno Rosemarin, Information Manager, Stockholm Environment Institute, Box 2142, S-103, 14 Stockholm, Sweden. Fax: 46 8 723 03 48. ■

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Update and ATAS News
Edited by Ian Steele

"...A periodic newsletter to keep national authorities, United Nations organizations and intergovernmental and non-governmental organizations informed of the progress made and related developments regarding the implementation of the Vienna Programme of Action" (IGC resolution 5(II)).

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